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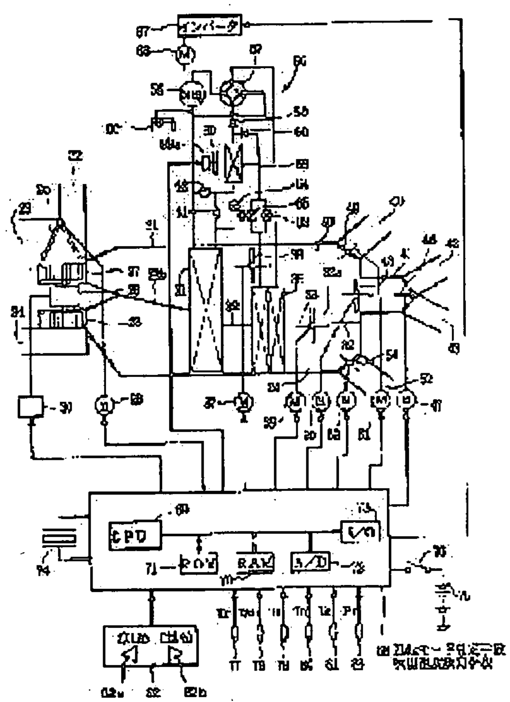
(54) **AIR CONDITIONER**

(57)Abstract:

PURPOSE: To attain energy saving effect without an sacrifice of comfortableness at the time of a manual mode by determining blow-off temperature based on auto mode wind quantity and required heat quantity when the auto mode wind quantity is larger than manual mode wind quantity at the time of judging the manual mode.

CONSTITUTION: An ECU 68 which inputs respective data of a temperature sensitive setter 82, an inside air temperature sensor 77, an outside air temperature sensor 78, a solar radiation sensor 79, an evaporator outlet temperature sensor 80, and a condenser outlet, temperature sensor 81 determines heat quantity required for air conditioning. Whether it is in an auto mode or a manual mode is judged, and at the time of manual mode, an auto mode wind quantity VA0 or a manual mode wind quantity VM are compared with each other. In the case of VA0≥VM, blow-off temperature TA0 is determined based on VA0 and QA0. In the case of VA0<VM, the blow-off temperature TA0 is determined based on VM and QA0. It is thus possible to attain comfortable air conditioning, at the time of the manual mode, by supplying proper heat quantity (= required heat quantity QA0) to the inside of a room.



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Element 80 is a post evaporator temperature sensor.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention relates to the air conditioner equipped with the function which controls the blow-off temperature and blow-off air capacity of the wind which blows off indoors.
[0002]
[Description of the Prior Art] If an operation mode is changed to the auto (AUTO) mode, the so-called auto air-conditioner carried in the automobile in recent years will carry out automatic control of blow-off temperature or the blow-off air capacity so that the temperature of the vehicle interior of a room may be maintained to the setting temperature set up by the temperature configuration switch. If air capacity is changed from this auto mode to the manual mode set up by manual operation, blow-off air capacity will be fixed to the air capacity set up with the air-capacity circuit changing switch, and blow-off temperature will be controlled to maintain the temperature of the vehicle interior of a room in this air capacity to setting temperature.
[0003]
[Problem(s) to be Solved by the Invention] Conventionally [above-mentioned], if blow-off air capacity is set up in the manual mode in the thing of a configuration, the manual mode air capacity will be rectified compared with auto mode air capacity, so that it may become higher than the time of blow-off temperature being the auto mode at the time of air conditioning when large. In this case, since the direction made into large air capacity for generating the same heating value can improve COP (coefficient of performance) of a refrigerating cycle, if manual mode air capacity is made [many], COP of the part and a refrigerating cycle can be improved and there is an advantage from which the energy-saving effect is also acquired.
[0004] However, at the time of air conditioning, in order that manual mode air capacity may maintain the temperature of the vehicle interior of a room in parvus air capacity to setting temperature at a parvus case compared with auto mode air capacity, it is rectified so that it may become lower than the time of blow-off temperature being the auto mode. For this reason, contrary to an above-mentioned case, COP of a refrigerating cycle falls and there is a fault in which consumption energy increases.
[0005] this invention was not made in consideration of such a situation, and the purpose is in offering the air conditioner which can acquire the energy-saving effect, without spoiling the amenity at the time of the manual mode.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the air conditioner of this invention In the thing equipped with the function which controls the blow-off temperature and blow-off air capacity of the wind which blows off indoors A means to calculate a heating value required for indoor air-conditioning, and an operation-mode judging means to judge the auto mode which carries out automatic control of the blow-off air capacity, or the manual mode in which blow-off air capacity is set up by manual operation, At the time of the manual mode, auto mode air capacity and manual mode air capacity are measured. When the auto mode air capacity is larger, blow-off temperature is determined based on the auto mode air capacity and the aforementioned required heating value. When the manual mode air capacity is larger, it considers as the configuration equipped with a blow-off temperature decision means to determine blow-off temperature based on the manual mode air capacity and the aforementioned required heating value.
[0007]
[Function] At the time of air-conditioning operation, while a heating value required for indoor air-conditioning is calculated, the auto mode or the manual mode is judged by the operation-mode judging means. Consequently, if judged with the manual mode, a blow-off temperature decision means measures auto mode air capacity and manual mode air capacity, and when the auto mode air capacity is larger, it will determine blow-off temperature based on the auto mode air capacity and the aforementioned required heating value. In this case, since it is a time of sensing that crew wants to weaken an air conditioning when crew makes manual mode air capacity small although the heating value supplied indoors becomes less than the aforementioned required heating value, since it becomes the same as that of the time of blow-off temperature being the auto mode even if manual mode air capacity is smaller than auto mode air capacity, it becomes the blow-off temperature which suited crew's sense of heat as a result, and the amenity improves conventionally. And since there are few heating values supplied indoors and they end, the energy-saving effect is also acquired.
[0008] On the other hand, when manual mode air capacity is larger than auto mode air capacity, blow-off temperature is determined based on the manual mode air capacity and the aforementioned required heating value. A proper heating value (= required heating value) is supplied indoors by this, and the amenity is maintained.

[0009]
[Example]
The 1st example which applied the [1st example] this invention to the air conditioner of an electric vehicle is explained with reference to the drawing 1 or the drawing 9 . First, the outline configuration of the whole air conditioner is explained based on drawing 2 . The open air inhalation opening 22 which inhales vehicle outdoor air (open air), and the two bashful inhalation openings 23 and 24 which inhale the air (bashful) of the vehicle interior of a room are formed in the upstream side of the ventilation case 21. By forming the inside-and-outside mind damper 25, among these adjusting the opening of the open air damper 25 with a servo motor 26, adjustable [of the mixed rate of the air inhaled from the open air inhalation opening 22 and the bashful inhalation openings 23 and 24] is carried out to the pars-intermedia grade of one bashful inhalation opening 23 and the open air inhalation opening 22, and an intake-air temperature is adjusted to it. Blowers 27 and 28 are formed in the lower-stream-of-a-river side of the bashful inhalation opening 24, respectively the lower-stream-of-a-river side of this inside-and-outside mind damper 25, and both [these] the blowers 27 and 28 are attached in the rotation axis of the blower motor 29. This blower motor 29 is driven by the drive circuit 30. Moreover, in the lower-stream-of-a-river side of blowers 27 and 28, the path is divided by dashboard 32b.
[0010] On the other hand, an evaporator 31 is arranged at the lower-stream-of-a-river side of blowers 27 and 28, and the lower-stream-of-a-river side of this evaporator 31 is divided into the ventilation flues 33 and 34 of two upper and lower sides by the dashboard 32. And a capacitor 35 is arranged in the lower ventilation flue 34, and the upper part of this capacitor 35 is projected in the upper ventilation flue 33. The strong cold damper 36 is arranged in the upper part of this capacitor 35, and it carries out adjustable [of the air capacity which bypasses a capacitor 35] by driving this strong cold damper 36 with a servo motor 37. Moreover, the free passage damper 38 is arranged, adjustable [of the air capacity which passes free passage opening 32a of a dashboard 32 by driving this free passage damper 38 with a servo motor 39] is carried out to free passage opening 32a prepared in the dashboard 32 by the side of the lower stream of a river of a capacitor 35, and the draft resistance at the time of single modes (for example, "VENT" mode, "FOOT" mode, etc.) is fallen to it.
[0011] The differential-gear outlet 40 and the vent blow-off path 41 are established in the lower-stream-of-a-river side of the upper ventilation flue 33, and the wide outlet 42 and the spot outlet 43 are formed in the lower-stream-of-a-river side of this vent blow-off path 41. In this case, as shown in drawing 3 , the wide outlet 42 is formed in the configuration of the upper part section of the meter panel 44 of a driver's seat, and the instrument panel 45 of a passenger side oblong two places, and blows off gently the wind of small air capacity (for example, 200m3/h, the wind speed of 3m / sec) from both [these] the wide outlet 42. On the other hand, a total of four spot outlets 43 is prepared in the center section and right-and-left both ends of an instrument panel 45, and they blow off the wind of large air capacity (for example, 400m3/h, the wind speed of 10m / sec) from these spot outlets 43. in addition, small air capacity (wide outlet 42) and a big wind -- a change of an amount (spot outlet 43) is performed by driving the spot / wide change damper 46 (referring to the drawing 2) formed in the outlet side of the vent blow-off path 41 with a servo motor 47
[0012] Moreover, dampers 48 and 49 are formed also in the entrance side and the differential-gear outlet 40 of the vent blow-off path 41, respectively, and each [these] dampers 48 and 49 drive with servo motors 50 and 51. On the other hand, the step outlet 52 which turns a wind at crew's feet and blows off is formed, and the damper 54 driven with a servo motor 53 also to this step outlet 52 is formed in the lower-stream-of-a-river side of the lower ventilation flue 34. According to the blow-off mode, each dampers 36, 38, 46, and 25 operate, as shown in the following table 1.
[0013]
[Table 1]

<table>
<tr><th colspan="2">ダンパ
吹出モード</th><th>強冷ダンパ36</th><th>連通ダンパ38</th><th>スポット/ワイド切替ダンパ46</th><th>内外気ダンパ25</th></tr>
<tr><td rowspan="2">FACE</td><td>スポット</td><td rowspan="6">冷房時
開放

暖房、除湿
除霜時
閉鎖</td><td>開放</td><td>スポット</td><td>——</td></tr>
<tr><td>ワイド</td><td>開放</td><td>ワイド</td><td>——</td></tr>
<tr><td colspan="2">B/L</td><td>閉鎖</td><td>ワイド</td><td>——</td></tr>
<tr><td colspan="2">FOOT</td><td>閉鎖</td><td>——
(ワイド)</td><td>——</td></tr>
<tr><td colspan="2">FOOT/DEF</td><td>閉鎖</td><td>——
(ワイド)</td><td>——</td></tr>
<tr><td colspan="2">DEF</td><td>開放</td><td>——
(ワイド)</td><td>——</td></tr>
<tr><td colspan="2">内気
〜 リニア
外気</td><td>——</td><td>——</td><td>——</td><td>内気
〜 リニア
外気</td></tr>
</table>

[0014] In this table 1 in FACE / "spot" mode the spot outlet 43 to a wind -- blowing off -- "-- FACE/-- wide -- in" mode A wind is blown off from the wide outlet 42. in "B/L" mode A wind is blown off from the both sides of the wide outlet 42 and the step outlet 52. in "FOOT" mode A wind is blown off from the step outlet 52 and the differential-gear outlet 40 at a rate of 80:20. in "FOOT/DEF" mode A wind is blown off from the step outlet 52 and the differential-gear outlet 40 at a rate of 50:50, and in "DEF" mode, each dampers 46, 48, 49, and 54 are changed so that a wind may be blown off from the differential-gear outlet 40. In addition, as the opening of the inside-and-outside mind damper 25 is mentioned later, it is controlled by the linear (linear).
[0015] On the other hand, the evaporator 31 and the capacitor 35 which were mentioned above serve as the component of the refrigerating cycle 55 of heat pump combination. This refrigerating cycle 55 connects a compressor 56, the four-way-type selector valve 57, the outdoor heat exchanger 58, the check valves 59 and 60, the capillary tube 61, the solenoid valves 62, 63, and 64, the reducing valve 65, the accumulator 90, the evaporator 31, and the capacitor 35 for piping, and is constituted. According to the operation mode of a refrigerating cycle 55, each solenoid valves 62, 63, and 64 and the four-way-type selector valve 57 are changed, as shown in the following table 2.
[0016]
[Table 2]

<table>
<tr><th colspan="2">入　力</th><th colspan="4">出　　力</th></tr>
<tr><td colspan="2">冷凍サイクル55の運転モード</td><td>電磁弁62</td><td>電磁弁63</td><td>電磁弁64</td><td>四方切替弁57</td></tr>
<tr><td colspan="2">OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF（実線）</td></tr>
<tr><td colspan="2">冷房</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON　（点線）</td></tr>
<tr><td colspan="2">暖房</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF（実線）</td></tr>
<tr><td colspan="2">（除霜）</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF（実線）</td></tr>
<tr><td rowspan="2">除湿</td><td>除湿H</td><td>OFF</td><td>OFF</td><td>ON</td><td>OFF（実線）</td></tr>
<tr><td>除湿C</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF（実線）</td></tr>
</table>

[0017] In the air conditioning mode, it changes to the position (on position) which the four-way-type selector valve 57 shows in drawing 2 by the dotted line, and the refrigerant breathed out from delivery 56a of a compressor 56 circulates in the path of inhalation opening 56b of the check-valve 59 -> outdoor heat exchanger 58 -> capillary-tube 61 -> evaporator 31 -> accumulator

90 -> compressor 56 so that clearly from this table 2. The elevated-temperature gas refrigerant breathed out from delivery 56a of a compressor 56 radiates heat and liquefies with an outdoor heat exchanger 58 by this, and when this liquid cooling intermediation evaporates by the evaporator 31, the wind which passes an evaporator 31 is cooled.
[0018] On the other hand, in the heating mode, it changes to the position (off position) which the four-way-type selector valve 57 shows in drawing 2 as a solid line, and the refrigerant breathed out from delivery 56a of a compressor 56 circulates in the path of inhalation opening 56b of the capacitor 35 -> reducing-valve 65 -> check-valve 60 -> outdoor heat exchanger 58 -> solenoid-valve 62 -> accumulator 90 -> compressor 56. The elevated-temperature gas refrigerant breathed out from delivery 56a of a compressor 56 radiates heat and liquefies by the capacitor 35 by this, and the wind which passes a capacitor 35 by this thermolysis is warmed.
[0019] Moreover, in the defrosting mode, a solenoid valve 63 is opened wide, the elevated-temperature gas refrigerant breathed out from delivery 56a of a compressor 56 is supplied also to an outdoor heat exchanger 58 via a capacitor 35 and the solenoid valve 63 in the position which the four-way-type selector valve 57 shows in drawing 2 as a solid line, and the frost adhering to the front face of an outdoor heat exchanger 58 is removed.
[0020] Furthermore, in the dehumidification H mode, a solenoid valve 63 is opened wide in the position which the four-way-type selector valve 57 shows in drawing 2 as a solid line, a solenoid valve 64 is wide opened with close, a part of liquid cooling intermediation supplied to the outdoor heat exchanger 58 is supplied also to an evaporator 31, and it is dehumidified by weaker cooling operation of this evaporator 31. Moreover, in the dehumidification C mode, a solenoid valve 63 is opened wide, an outdoor heat exchanger 58 also comes to function as a condenser with a capacitor 35, the refrigerant liquefied on the both sides of a capacitor 35 and the outdoor heat exchanger 58 is supplied to an evaporator 31 in the position which the four-way-type selector valve 57 shows in drawing 2 as a solid line, and it is dehumidified by stronger cooling operation of this evaporator 31.
[0021] In addition, the outdoor fan 89 for forced cooling is formed in an outdoor heat exchanger 58, and this outdoor fan's 89 fan motor 89a is changed to high-speed rotation "Hi" and low-speed rotation "Lo" and a halt "OFF" by the output data of the various sensors later mentioned with the operation mode of a refrigerating cycle 55, as shown in drawing 5 . For example, in the air conditioning mode, OAT Tam detected by the OAT sensor 78 serves as "Hi" above 25 degrees C, and serves as "Lo" below 22 degrees C. On the other hand, in the heating mode, OAT Tam serves as "Hi" below 13 degrees C, and serves as "Lo" above 16 degrees C. The blow-off temperature TAO later mentioned in the dehumidification H mode, and wind temperature (henceforth "capacitor outlet temperature") Tc immediately after capacitor 35 transit A temperature gradient [TAO-Tc] is stopped "OFF" below 0 degree C, serves as "Hi" above 2 degrees C, and serves as "Lo" in 1 degree C -> 2 degrees C and 1 degree C -> 0 degree C. Moreover, refrigerant discharge-pressure Pr of the compressor 56 detected by the refrigerant discharge-pressure sensor 88 in the dehumidification C mode, capacitor outlet temperature Tc, and TAO-Tc It determines by the priority of Hi>Lo>OFF. For example, refrigerant discharge-pressure Pr They are Tc and TAO-Tc if it is more than 19kgves/cm2 G. Whenever what value it is, it is set to "Hi", and it is TAO-Tc similarly. If it is -2 degrees C or less, it is refrigerant discharge-pressure Pr temporarily. Even if it is lower than 19kg[/cm]2 G, it is always set to "Hi."
[0022] On the other hand, as for the motor 66 which drives the compressor 56 of a refrigerating cycle 55, a rotational frequency is controlled by the inverter 67. The drive circuit 30 of fan motor 89a and blower motor 29 of this inverter 67, the servo motors 26, 37, 39, 47, 50, 51, and 53, and the outdoor fan 89 is controlled by the electronic control unit (henceforth "ECU") 68. This ECU68 is constituted considering a microcomputer as a subject, it has the quartz resonator 74 which generates the reference signal of ROM71 the control program of RAM70 which memorizes CPU69, various data, etc. temporarily, and the drawing 1 etc. is remembered to be, A/D converter 72 which changes input data into digital value, and MHz [several / 73 or] I/O section, and power is supplied through the ignition switch 76 from a battery 75.
[0023] This ECU68 bashful temperature Tr The bashful temperature sensor 77 and OAT Tam to detect the OAT sensor 78 to detect and intensity of radiation Ts which enters the vehicle interior of a room The sun sensor 79 to detect, the cold blast temperature immediately after evaporator 31 transit (It is called "evaporator outlet temperature" below) Te The evaporator outlet temperature sensor 80 and capacitor outlet temperature Tc to detect The capacitor outlet temperature sensor 81 and refrigerant discharge-pressure Pr of a compressor 56 to detect Setting sense-of-heat Sset used as the refrigerant discharge-pressure sensor 88 to detect and control objectives The output signal from the sense-of-heat setter 82 for crew doing a manual setup etc. is read through A/D converter 72.
[0024] The sense-of-heat setter 82 mentioned above is equipped with cooler key 82a and warmer key 82b, and as shown in drawing 2 , it is prepared in the air-conditioner control panel 83 arranged in the center section of an instrument panel 45. As shown in drawing 3 , the sense-of-heat display 84 which arranged 84n of two or more light emitting devices to the horizontal single tier is formed in the upper part of the sense-of-heat setter 82 at this air-conditioner control panel 83. This sense-of-heat display 84 is setting sense-of-heat Sset inputted by cooler key 82a and warmer key 82b. It displays. This setting sense-of-heat Sset It is the index which shows whether it is made how much cool on the basis of the average temperature of 25 degrees C, or it is made warm. [Refer to view 6] (a), In the status before operating each keys 82a and 82b Whenever it makes 84n of the light emitting devices of the center of the sense-of-heat display 84 turn on and it pushes cooler key 82a once Setting sense-of-heat Sset Whenever you make it fall at a time by 1 ******, it shifts every one lighting position on left-hand side and it pushes warmer key 82b once, it is setting sense-of-heat Sset. You make it go up at a time by 1 ******, and every one lighting position is shifted on right-hand side.
[0025] In addition, the auto (AUTO) switch 91 which the air-conditioner on-off switch 85, the rear defogger switch 86, and the front defroster switch 87 are formed in the air-conditioner control panel 83, and changes air-conditioning operation from the

manual mode to the auto mode further, the off switch 92 which stops air-conditioning operation, and four manual mode air-capacity circuit changing switches Lo, M1, M2, and Hi which change manual mode air capacity to four phases It is prepared.
[0026] On the other hand, while ECU68 calculates the heating value QAO required for indoor air-conditioning by performing the control program of drawing 1 It functions as an operation-mode judging means to judge the auto mode or the manual mode. further at the time of the manual mode The auto mode air capacity VAO and manual mode air capacity VM It compares. VAO>=VM Sometimes based on the auto mode air capacity VAO and the aforementioned required heating value QAO, the blow-off temperature TAO is determined. VAO<VM Sometimes, it is the manual mode air capacity VM. It functions also as a blow-off temperature decision means to determine the blow-off temperature TAO based on the aforementioned required heating value QAO.
[0027] Hereafter, the content of a control by this ECU68 is explained according to the flow chart of drawing 1 . First, setting sense-of-heat Sset which shifts to step 110 and was inputted by operation of the sense-of-heat setter 82 at step 100 after performing initialization processing which carries out the initial cofiguration of the counter used for subsequent data processing, or the flag While reading By the bashful temperature sensor 77, the OAT sensor 78, the sun sensor 79, the evaporator outlet temperature sensor 80, and the capacitor outlet temperature sensor 81 The detected bashful temperature Tr, OAT Tam, the intensity of radiation Ts, and evaporator outlet temperature Te And capacitor outlet temperature Tc Each data is read.
[0028] subsequently, the step 120 -- shifting -- setting sense-of-heat Sset, OAT Tam, and intensity of radiation Ts **** -- setting temperature Tset It asks by the following (1) formula.
Tset =f(Sset ,Tam,Ts)
= Tset'+deltaTam+deltaTs .... (1)
Here, it is Tset'=25+0.4Sset. .... View 6 (a) referring-to deltaTam= (10-Tam)/20 .. Drawing 6 (b) reference deltaTs =-Ts / 1000 .. Refer to view 6 (c) [0029]. It is setting temperature Tset as mentioned above. After computing, it shifts to step 130, and it is setting temperature Tset about the vehicle interior of a room. The heating value QAO required in order to maintain is computed by the following (2) formulas.
QAO=K1 xTset-K2 xTr-K3 xTam-K4 xTs+C .... (2)
Here, it is K1, K2, K3, and K4. A coefficient and C are constants. This (2) formula is each coefficients K1, K2, K3, and K4, although it is the same as that of the former seemingly. Constant C is set as the value quite bigger than the former.
[0030] After computing the required heating value QAO by the above-mentioned (2) formula, it shifts to step 140 and judges as follows whether the air-conditioning status at the time is a steady state, or it is a transient. First, setting temperature Tset Bashful temperature Tr Temperature-gradient |Tset-Tr | is computed and it judges whether this |Tset-Tr | is below predetermined value delta (for example, delta= 3 degrees C), if it is |Tset-Tr |<=delta, it will be judged as a steady state, and if it is |Tset-Tr |>delta, it will be judged as a transient.
[0031] An air-capacity property to air-capacity VB to the required heating value QAO at the time of the stationary which shifts to step 141 at the time of a steady state, and is shown in drawing 7 It asks and is this air-capacity VB. It considers as the blow-off air capacity VAO (this VAO serves as the auto mode air capacity at the time of a stationary). In addition, drawing 7 shows the air capacity and the temperature characteristic of this example as a solid line, and shows the air capacity and the temperature characteristic of the conventional auto air-conditioner with the alternate long and short dash line. Although the air-capacity property of this example aims at the enhancement in COP of a refrigerating cycle 55 and air-capacity VB is made to increase conventionally in the field with few required heating values QAO so that clearly from this drawing 7 , this increase in air capacity is set as the grade crew does not feel a wind offensively. By adopting such an air-capacity property, the temperature characteristic of this example has the blow-off temperature TAO higher than the former 5 degrees C, for example at the time of air conditioning, and at the time of heating, it is set up so that 15 degrees C may become low rather than the former, for example.
[0032] On the other hand, when judged as a transient at step 140 mentioned above, it shifts to step 142 and the blow-off air capacity VAO is computed by the following (3) formulas (this VAO serves as the auto mode air capacity at the time of a transient).
VAO=VB+deltaV .... (3)
Here, it is VB. It is asked from the air-capacity property over the required heating value QAO at the time of the stationary shown in drawing 7 . Moreover, deltaV is correction air capacity and is calculated from the correction air-capacity property over Tr-Tset shown in drawing 8 . In this example, correction air-capacity deltaV is set up so that it may be set to "0" at the time of heating. When this ground makes the blow-off air capacity VAO increase sharply at the time of heating, it is because the warmth which the crew who the blow-off temperature TAO falls too much, and hits in the style of blow off senses decreases on the contrary (however, you may set up so that it may mention later and it may become crew with deltaV>0 within limits which do not give displeasure also at the time of heating).
[0033] If the blow-off air capacity VAO is determined by step 141 mentioned above or 142, it will progress to step 150 and the air-capacity setting mode will judge the auto mode or the manual mode. If either of the manual mode air-capacity circuit changing switches 93-96 is turned on, this judgment will be judged to be the manual mode, otherwise, will be judged to be the auto mode. Air-capacity VA which will progress to step 151 and will blow off to the vehicle interior of a room at this step 150 if judged with the auto mode The value VAO determined by step 141 mentioned above or 142 is set, and it progresses to step 160.
[0034] On the other hand, in the case of the manual mode, it progresses at step 152, and they are the manual mode air-capacity circuit changing switches Lo, M1, M2, and Hi. It is [any are turned on and] the manual mode air capacity VM. It sets as follows. For example, Lo At the time of ON, it is VM=200 (m3/h) and M1. At the time of ON, it is VM =270 (m3/h) and M2. At the time

of ON, they are VM =340 (m3/h) and Hi. At the time of ON, it is set with VM =400 (m3/h).
[0035] Then, it progresses to step 153 and is this manual mode air capacity VM. It compares with the auto mode air capacity VAO calculated by step 141 mentioned above or 142. The auto mode air capacity VAO is the manual mode air capacity VM. If it is above, it will progress to step 154. Air-capacity VA which blows off to the vehicle interior of a room Manual mode air capacity VM While setting, the auto mode air capacity VAO is set to VAO' for calculating the blow-off temperature TAO by (4) formulas mentioned later.
[0036] On the other hand, it is the manual mode air capacity VM. Air-capacity VA which progresses to step 155 and blows off to the vehicle interior of a room when the direction is larger than the auto mode air capacity VAO Manual mode air capacity VM It is the manual mode air capacity VM to VAO' for calculating the blow-off temperature TAO by (4) formulas mentioned later, while setting. It sets.
[0037] If VA and VAO' are determined by step 154 or 155 as mentioned above, it will progress to step 160 and the blow-off temperature TAO will be computed by the following (4) formulas.
TAO=QAO/(Cp, gamma, andVAO')+Tr=3.57xQAO/VAO'+Tr .... (4)
[Cp The specific heat of :air, specific gravity (25 degrees C)] of gamma:air
VAO' in the above-mentioned (4) formulas is VAO'=VAO at the time of VAO>=VM (step 154). Therefore, manual mode air capacity VM Since the blow-off temperature TAO calculated by the above-mentioned (4) formula becomes the same as that of the time of the auto mode even if it is smaller than the auto mode air capacity VAO, although the heating value supplied indoors becomes less than the required heating value QAO calculated at step 130 Crew is the manual mode air capacity VM. Since it is a time of sensing that crew wants to weaken an air conditioning when making it small, it becomes the blow-off temperature TAO which suited crew's sense of heat as a result, and the amenity improves conventionally. And since there are few heating values supplied indoors and they end, the energy-saving effect is also acquired.
[0038] On the other hand, it is the manual mode air capacity VM. It is VAO'=VM when larger than the auto mode air capacity VAO. Since it becomes, the blow-off temperature TAO is the manual mode air capacity VM. It is calculated based on the required heating value QAO calculated at step 130. A proper heating value (= required heating value QAO) is supplied indoors by this, and the amenity is maintained.
[0039] If the blow-off temperature TAO is calculated by (4) formulas mentioned above, it will shift to step 170 and the opening of the inside-and-outside mind damper 25 will be computed as follows in the orientation which makes small the temperature gradient of the temperature (henceforth a "intake-air temperature") Tin of air and the blow-off temperature TAO which are inhaled from the bashful inhalation openings 23 and 24 and the open air inhalation opening 22. Generally, it is asked for an intake-air temperature Tin by the following (5) formulas.
Tin=alphaandTam+ (1-alpha), Tr .... (5)
(Mixed rate of alpha:open air)
The absolute value Tdi of the temperature gradient of the blow-off temperature TAO at the time (alpha= 0) of completeness bashful and the intake-air temperature Tin (=Tr) is first computed by the following (6) formulas using this relation.
Tdi=|TAO-Tr | .... (6)
Subsequently, the absolute value Tdo of the temperature gradient of the blow-off temperature TAO of the open air maximum harvesting time (alpha is the maximum) and the intake-air temperature Tin is computed by the following (7) formulas.
Tdo=|TAO-{alphaandTam+ (1-alpha), and Tr} | .... (7)
Then, Tdi is compared with Tdo, the size is judged, if it is Tdi<=Tdo, it will consider as the bashful mode (alpha= 0), and the close by-pass bulb completely of the open air inhalation opening 22 will be carried out with the inside-and-outside mind damper 25.
[0040] On the other hand, if it is Tdi>Tdo, it will consider as the open air mode and mixed rate x of the open air will be computed by the following (8) formulas.
x=(TAO-Tr)/(Tam-Tr) .... (8)
0 when x computed by this (8) formula is within the limits of value [of alpha of the open air maximum harvesting time] (alphamax), and value (alpha= 0) of alpha at time of the bashful mode <=x<=alphamax Sometimes It becomes the inside-and-outside mind combined use mode which makes this x a target open air mixture rate, and carries out adjustable [of the opening of the inside-and-outside mind damper 25] to a linear (linear) so that this target open air mixture rate x may be realized.
[0041] By performing such a control, the opening of the inside-and-outside mind damper 25 is automatically adjusted in the orientation which makes small the difference of the blow-off temperature TAO and the intake-air temperature Tin, there are few heating values (required heating value QAO) given to the inhaled air, and they end, and much more power-saving-ization of them is attained.
[0042] If it finishes computing the opening of the inside-and-outside mind damper 25 at step 170 mentioned above, it will shift to step 180 and will judge as follows whether the operation mode of a refrigerating cycle 55 is made into which the mode of air conditioning and heating. First, an intake-air temperature Tin is computed by (5) formulas mentioned above. In this case, an intake-air temperature Tin is computed as mixed rate [of the open air] alpha using x computed at step 170 mentioned above. Subsequently, temperature-gradient TM of the blow-off temperature TAO and the intake-air temperature Tin It computes by the following (9) formulas.
TM =TAO-Tin .... (9)
And at the time of TM >=+theta (for example, theta= 2 degrees C), it considers as the heating mode, and considers as the air

conditioning mode at the time of TM <=-theta, and the compressor 56 of a refrigerating cycle 55 is suspended at the time of -theta<TM <+theta.

[0043] Thus, after judging the operation mode of a refrigerating cycle 55, it shifts to step 190, the opening of each dampers 36, 38, 46, 48, 49, and 54 is determined based on the blow-off temperature TAO and the blow-off air capacity VAO, and the blow-off mode is determined as "FACE (spot)", "FACE (wide)", "B/L", "FOOT", "FOOT/DEF" or, and "DEF." The detail in this blow-off mode is expressed to Table 1 shown above.

[0044] Air-conditioning operation is controlled by returning to step 110 which outputted various kinds of control data determined as mentioned above to each device (step 200), and mentioned them above henceforth, and repeating processing. In this case, in order to realize air-capacity VA calculated at step 151,154,155, the blower voltage impressed to the blower motor 29 is determined by the voltage characteristic of drawing 9 according to the blow-off mode.

[0045] In this case, it is setting temperature Tset about the vehicle interior of a room. When the blow-off temperature TAO required to maintain can be made by mixture of the open air as it is bashful, the compressor 56 of a refrigerating cycle 55 is suspended. On the other hand, only by inside-and-outside mind, when the required blow-off temperature TAO cannot be made, a compressor 56 is driven by the inverter 67 and a refrigerating cycle 55 is operated by the operation mode determined at step 180. In this case, evaporator outlet temperature Te detected by the evaporator outlet temperature sensor 80 in the air conditioning mode Capacitor outlet temperature Tc which makes it an object, and carries out feedback control with PI control or a fuzzy control, and was detected by the capacitor outlet temperature sensor 81 in the heating mode It is made an object and feedback control is carried out with PI control or a fuzzy control.

[0046] When performing PI control, it is a temperature distribution En by the following (10) formulas first. It computes.

En =TAOn-Tn .... (10)

Here, it is subscript n of each variable. It is shown that it is the n-th sampled value, and it is TAOn. The blow-off temperature for which it asked at step 142,144 is shown, and it is Tn. In the air conditioning mode, it is capacitor outlet temperature Tc in evaporator outlet temperature Te and the heating mode. It is shown.

[0047] Subsequently, frequency variation Dfn of an inverter 67 It computes by the following (11) formulas.

Dfn =Kp {(En-En-1)+t/TI, and En} .... (11)

Here, it is Kp. Proportional gain and t are a sample time and TI. It is the reset time. this frequency variation Dfn **** -- target frequency fn of an inverter 67 It computes by the following (12) formulas.

fn =fn-1+Dfn .... (12)

This target frequency fn It outputs to an inverter 67 and the rotational frequency of a compressor 56 is controlled.

[0048] According to the 1st example explained above, they are the auto mode air capacity VAO and the manual mode air capacity VM at the time of the manual mode. It compares. VAO>=VM Since the blow-off temperature TAO is sometimes determined based on the auto mode air capacity VAO and required heating value QAO VAO>=VM Although the heating value which sometimes becomes the same as that of the time of the blow-off temperature TAO being the auto mode, and is supplied indoors becomes less than the required heating value QAO calculated at step 130 Crew is the manual mode air capacity VM. Since it is a time of sensing that crew wants to weaken an air conditioning when making it small, it becomes the blow-off temperature TAO which suited crew's sense of heat as a result, and the amenity improves conventionally. And since there are few heating values supplied indoors and they end, the energy-saving effect is also acquired. On the other hand, it is the manual mode air capacity VM. When larger than the auto mode air capacity VAO, the blow-off temperature TAO is the manual mode air capacity VM. Since it is calculated based on the required heating value QAO calculated at step 130, a proper heating value (= required heating value QAO) is supplied indoors, and the amenity is maintained.

[0049] In addition, although it was made to progress to step 154 in the 1st above-mentioned example when the auto mode air capacity VAO and the manual mode air capacity VM were the same values (VAO=VM), although it progresses to step 154, it cannot be overemphasized that the completely same result is obtained.

[0050] the [2nd example] 1st example -- the manual operation of the sense-of-heat setter 82 -- sense-of-heat Sset setting up -- this setting sense-of-heat Sset OAT Tam and intensity of radiation Ts **** -- setting temperature Tset although it is made to compute -- the sense-of-heat setter 82 -- replacing with -- setting temperature Tset preparing the setting heat sensitive switch (not shown) which carries out a manual setup, and operating this setting heat sensitive switch manually -- setting temperature Tset You may be made to set up. In this case, step 120 of drawing 1 becomes unnecessary.

[0051] At the [3rd example] 1st example, it is setting temperature Tset about decision of a stationary and a transient. Bashful temperature Tr Although judged by whether absolute value |Tset-Tr | of a temperature gradient is below predetermined value delta (for example, delta= 3 degrees C), as shown in drawing 10 , you may be made to judge a stationary and a transient by the size of the change speed per unit time of (Tr-Tset). In this case, according to the change speed per unit time of (Tr-Tset), correction air-capacity deltaV will be calculated from the correction air-capacity property of drawing 10 .

[0052] In addition, decision of a stationary and a transient is the bashful temperature Tr. You may judge by the size of the change speed per unit time, or it may judge by the merits and demerits of the elapsed time after an air-conditioning start up, and when it detects further that the external environmental condition sudden-change-ized by the output signal of the OAT sensor 77 or the sun sensor 79, you may be made to judge with a "transient."

[0053] In the thing of a configuration of having had sense-of-heat auxiliary machinery, such as HWS (Heating Window Shield) which warms the sheet heater with which the seat of the [4th example] automobile is heated, the radiation heater formed in the internal-surface-of-parietal-bone panel of a door, or a glass pane, between step 130 of drawing 1 , and step 140, as shown in

drawing 11 , an operation judging (step 131) of sense-of-heat auxiliary machinery and processing of correction (step 132) of the required heating value QAO are added.
[0054] In this case, it judges whether it is QAO>=beta (heating is required) or it is QAO<beta (heating is unnecessary), and if the required heating value QAO computed at step 130 is QAO>=beta, it will turn on sense-of-heat auxiliary machinery, and will compensate heating capacity with an operation judging of the sense-of-heat auxiliary machinery in step 131. On the other hand, if it is QAO<beta, since there is no need for heating, it turns off sense-of-heat auxiliary machinery.
[0055] Moreover, in the correction of the required heating value QAO in step 132, in order to reduce the blow-off temperature TAO of warm air according to the calorific value of sense-of-heat auxiliary machinery, it rectifies so that the required heating value QAO may be made small by the calorific value of sense-of-heat auxiliary machinery.
[0056] Although in the case of the [other examples] 1st example only correction air-capacity delta V makes the blow-off air capacity VAO increase from the time of a stationary at the time of a transient and it is made to improve COP of a refrigerating cycle 55 at the time of air conditioning, since correction air-capacity deltaV is set as "0" (refer to the drawing 8), it becomes the same air-capacity property as the time of a stationary also in the time of a transient at the time of heating. When this ground makes the blow-off air capacity VAO increase sharply at the time of heating, it is because the warmth which the crew who the blow-off temperature TAO falls too much, and hits in the style of blow off senses decreases on the contrary.
[0057] However, correction air-capacity deltaV is set as deltaV>0 also at the time of heating, and it may be made to make it increase to the grade which does not give the blow-off air capacity VAO at the time of a transient, and does not give crew displeasure. In this case, although the blow-off temperature TAO falls according to the augend of the blow-off air capacity VAO, since the heating value given to the vehicle interior of a room can secure a required heating value by the increase in air capacity, it can raise COP of a refrigerating cycle 55 also at the time of the transient at the time of heating so that it cannot reduce heating capacity.
[0058] Moreover, although the 1st example applies this invention to the air conditioner of an electric vehicle, it cannot be overemphasized by that this invention may be applied to various kinds of air conditioners, such as an air conditioner of an engine drive formula automobile, and an air conditioner of a house. In the case of the air conditioner of an engine drive formula automobile, it is good also as a configuration which may use the heat core through which an engine cooling water circulates, and uses an electric heater as a heat source at the time of heating by the general air conditioner as a heat source at the time of heating.
[0059] Moreover, although a wind is strongly blown off from the spot outlet 43 at the time of large air capacity and a wind is gently blown off from the wide outlet 42 in the 1st example at the time of small air capacity, you may be made to blow off a wind from the both sides of both [these] the outlets 42 and 43 simultaneously. Of course, it is good also as a configuration without a spot / wide change, and a spot / wide change damper 46 becomes unnecessary in this case.
[0060] Moreover, the sense-of-heat setter 82 is not limited to the thing of a key input method, for example, may be constituted using a dial switch. In addition, this invention cannot be overemphasized by the grade which may change suitably a ventilation-related configuration and the configuration of the sense-of-heat display 84, and that it changes variously and can carry out.
[0061]
[Effect of the Invention] According to this invention, so that clearly from the above explanation at the time of the manual mode Since auto mode air capacity and manual mode air capacity are measured, and blow-off temperature is determined based on the auto mode air capacity and required heating value when the auto mode air capacity is larger In this case, although the heating value which becomes the same as that of the time of blow-off temperature being the auto mode, and is supplied indoors becomes less than a required heating value Since it is a time of sensing that crew wants to weaken an air conditioning when crew makes manual mode air capacity small, it becomes the blow-off temperature which suited crew's sense of heat as a result, and the amenity improves conventionally. And since there are few heating values supplied indoors and they end, the energy-saving effect is also acquired. On the other hand, when manual mode air capacity is larger than auto mode air capacity, since blow-off temperature is determined based on manual mode air capacity and a required heating value, a proper heating value (= required heating value) is supplied indoors, and the amenity is maintained.

[Translation done.]